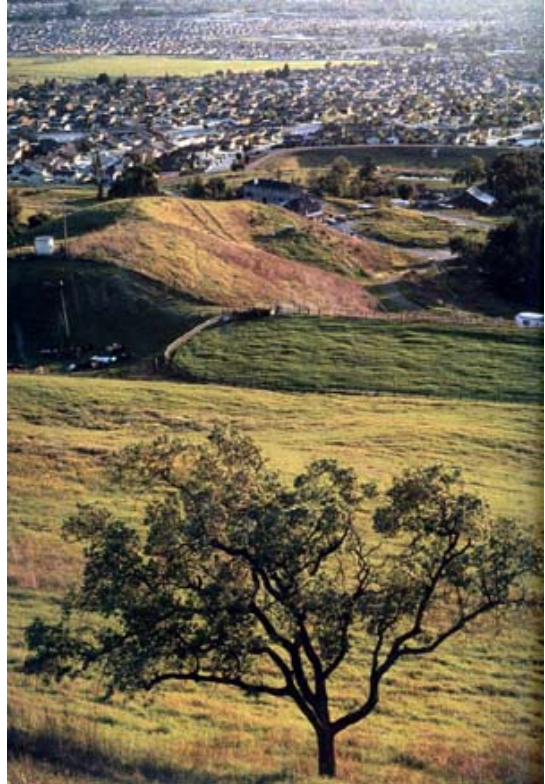


Habitat Loss and Alteration

Loss of significant alteration of natural vegetation is a major factor affecting biodiversity, soil conservation and water quality, fire regimes, and other ecological processes. Land use changes that convert landscapes dominated by native vegetation to urban or agricultural uses often alter ecological processes and negatively effect the goods and services derived from these systems. These concerns were recognized by the Montreal Process with Indicator 5 (fragmentation of forest types) and Indicator 15 (area and percent of forest affected by processes or agents beyond the range of historic variation).

Habitat alteration can be measured at several levels. These include changes in the variety of habitats and communities, species diversity (the number and mix of species within an ecosystem), and genetic diversity (variation within a species). Within any given landscape, shifts in the mix and relative diversity of species supported are frequently determined by the alterations in the arrangement of habitats. Habitat conditions vary over time and along a range of plant communities (successional stages) determined by a number of factors, such as historical and current land management activities.



Urban encroachment into native communities.

Some factors have a long lasting impact on habitat and the mix of associated fish and wildlife. Examples include conversion of forests and rangelands to development or intensive agriculture. Other impacts of alteration are harder to measure, such as competition between species, significance of overlapping habitats, predation and disease, and migration conditions.

Informed management can help preserve and enhance the health and vitality of California's forests and rangelands. Change in land use and alteration of vegetation cover should be part of the information gathering and decision-making processes. To provide this kind of information, the Fire and Resource Assessment Program (FRAP) Assessment uses several sources to gauge the status of the forest and rangeland base (see below). Each provides a different perspective on the multi-faceted issues of habitat loss and alteration. See the Assessment document [Assessment Information Systems](#).

- **Historical loss of forests and rangelands:** Historical losses of forest and rangelands by bioregion are determined by comparing the current estimates of urban and agricultural lands as a proxy for loss of native landscapes. FRAP uses the latest land cover mapping products to estimate

current extent of agriculture and urban lands, current remaining extent of forest and rangelands and determine bioregional losses.

- **Current pattern of rural residential land use:** The 2000 U.S. Census coverage provides detailed spatial coverage of current housing density. The combination of 2000 Census data with current land cover data provides a very detailed portrait of the current status of rural residential lands where there is a combination of low-density housing structures (between 1 housing unit per to 20 units per acre) intermixed with some level of habitat. Focus on the extent and location of rural residential lands provides an indication of future conversion to high-density urban uses.
- **Projected development:** The analysis of projections of potential development on forests and rangelands uses a combination of historical and current data from the U.S. Census and California Department of Finance population projections. This analysis quantifies land use changes by land cover type, due to residential development between 2000 and 2040. See the web page [Information and Data Center](#) and the Assessment document [Assessment Information Systems](#)
- **Changes in land use:** The Natural Resources Conservation Service's National Resource Inventory (NRI) is a ground-based fixed plot sampling survey conducted every five years to evaluate the change in extent of non-federal lands. These changes include conversion of lands to another use (such as forest land to developed land) and transfers of private land to public ownership. The program has information available from 1982 to 1997. [National Resource Inventory](#)
- **Land cover change:** The California Department of Forestry and Fire Protection (CDF) has directly addressed the need to monitor changes in forests and rangelands. The [California Land Cover Mapping and Monitoring Program](#) (LCMMP), a cooperative program between the U.S. Forest Service (USFS) and CDF, has developed vegetation and monitoring data for all ownerships and vegetation types. Monitor information focuses on the change in vegetation canopy cover over five year evaluation intervals. See the Assessment document [Assessment Information Systems](#).

Other sections in the Assessment also provide related information on changes in land use. These include the conversion of timberlands as determined by trends in issuance of conversion permits, estimates of decadal changes in timberland area (see the Assessment document [Forest Land Base](#)), and changes in the rangeland base using data from the California Farmland Mapping and Monitoring Program (see the Assessment document [Rangeland Area and Condition](#)).

Findings on current extent and historical loss of forest and range habitats in California

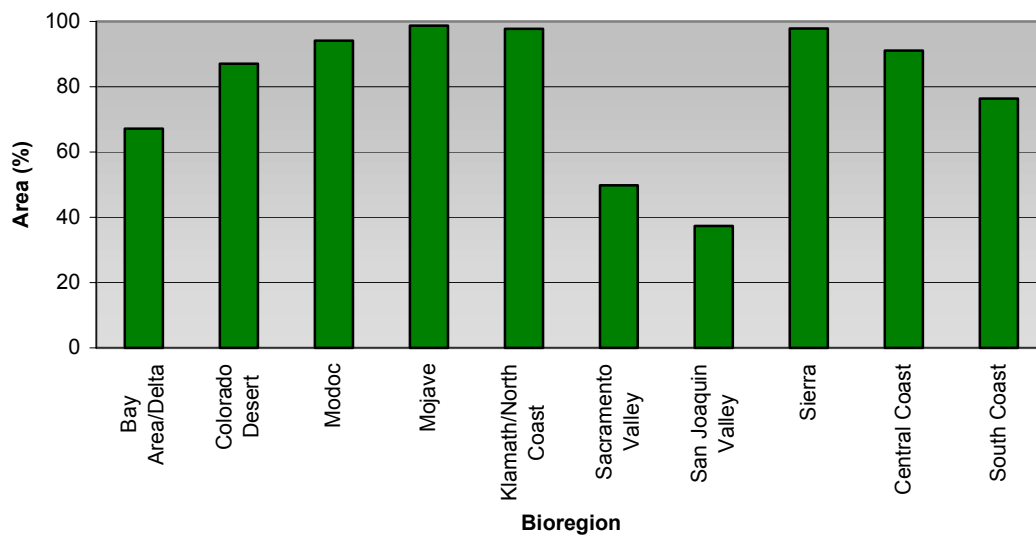
Several forest and rangeland habitats have been markedly altered in extent based on pre-European estimates (Noss et al., 1995). Some prominent examples include the following:

- Ninety-nine percent loss of native grassland (Kreissman, 1991) including 26 percent of native annual and perennial grasslands lost between 1945 and 1980 (Mayer and Laudenslayer, 1988).
- Seventy to 90 percent of pre-settlement southern California coastal sage scrub converted to other uses (Westman fide Noss et al., 1995; Atwood 1990; Oberbauer fide Noss et al., 1995; O'Leary 1990; U.S. Fish and Wildlife Service, 1992).
- More than 99 percent loss of alkali sink scrub in southern California (Freas and Murphy, 1988).

- Fourteen percent loss of hardwood woodlands (Bolsinger, 1988).
- Eighty-nine percent loss of riparian woodland Statewide (Kreissman, 1991).
- Sixty-six to 88 percent loss of Central Valley vernal pools (Holland, 1978; Kreissman, 1991).

Figure 1 summarizes the remaining level of vegetation land covers compared to pre-settlement levels in California. These estimates focus on impacts from urbanization (densities greater than one housing unit per acre) and land conversion to irrigated agricultural uses, the primary land uses that have significantly impacted California's landscape. Overall, California has lost an estimated 14 percent of natural land cover as of 2000, and impacts vary by bioregion. The San Joaquin Valley bioregion has incurred the greatest loss of natural vegetation (67 percent). The Bay Area/Delta bioregion shows an approximately 33 percent loss of area primarily due to urban development.

Figure 1. Percentage area of pre-settlement vegetation remaining by bioregion, 2000

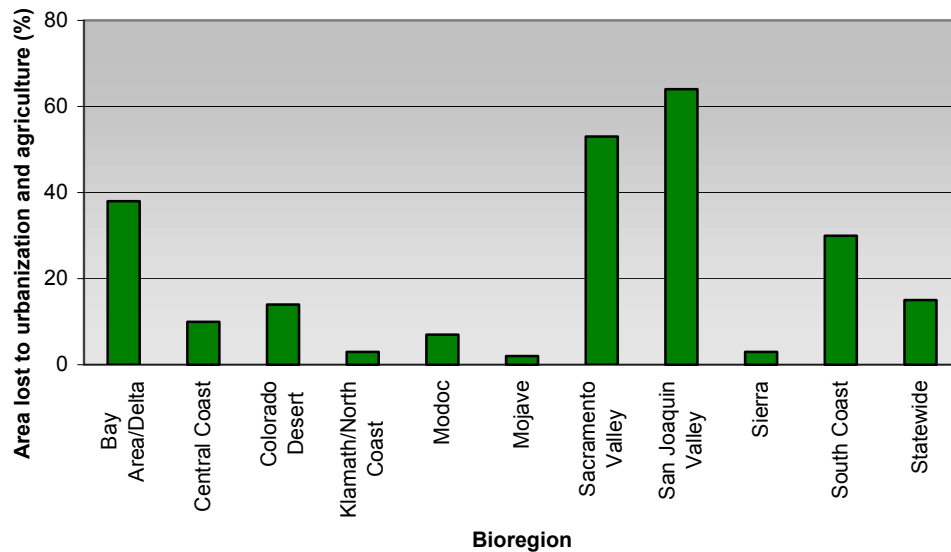


Source: FRAP, 2002a

One of the regional indicators used to measure the status of habitat loss relates to the change in extent (area) of forests and rangelands over time to urbanization and intensive agriculture. Loss of habitat has been most evident in the San Joaquin Valley, Sacramento Valley, South Coast, and Bay Area/Delta bioregions. These changes exemplify California's transition from a state known for utilizing its abundant natural resources to a highly urban state living among these resources (Figure 2).

While these estimates reflect outright losses of natural vegetation, additional impacts to fully functioning ecosystems have occurred. In the next section, an analysis of "parcelization" is conducted. Parcelization is defined as low-density rural development—densities of at least one housing unit per 20 acres but not exceeding one housing unit per acre. The more extensive parcelization at the fringes of urban areas retains at least some ecologically important characteristics, but generally have diminished functionality to the remaining habitat. Taken together, two categories of impacts to natural vegetation account for majority of habitat loss and alteration.

Figure 2. Percentage area of forests and rangelands lost to urbanization* and intensive agricultural conversion, by bioregion and statewide, pre-1600s era to present



*housing density of one or more units per acre or commercial/industrial use
Source: FRAP, 2002a; FRAP 2003c

A more contemporary estimate focusing on impacts to forestlands shows a loss of about four percent in the forested land base in California between 1953 and 1997 (Smith et al., 2001). This estimate was published as part of the periodic national resource assessment mandated by the USFS to meet the requirements of the federal Forest and Rangeland Renewable Resources Planning Act of 1978.

The preponderance of these losses can be traced to human alteration of native plant communities because of human settlement, reclamation, timber harvest, and grazing during the gold rush era (McBride et al., 1996). In the mid-1800s, the rapid expansion of agriculture, cattle and sheep grazing, water diversion, and timber harvesting all played major roles in transforming land use within forest and rangeland areas. Since World War II, rapid population growth supported by the development of new infrastructure to move raw materials, water, and people around the State has brought a new set of external impacts to bear on the forest and rangeland resources of California.

Today, population expansion into existing open space with its associated release of air and water borne pollutants, loss of key habitats, demand for recreation, and desire for healthy and sustainable environments are all significant resource-related concerns in California. The Assessment identified development as the main change-agent operating on landscapes and natural processes. The California Department of Fish and Game shares this view, citing urbanization as the main cause leading to the listing of species as threatened or endangered (California Department of Fish and Game, 1991). The same finding was made by the National Wildlife Federation that said the low-density, automobile-dependant development (sprawl) into the natural areas outside of cities and towns is the biggest cause of species imperilment in California. Sprawl outranked all other factors, affecting 188 of the 286 California species (66 percent) listed as threatened or endangered under the federal Endangered Species Act (Doyle et al., 2001).

Housing development on forests and rangelands

One objective of the Assessment is to explore trends of future land development pressure on forests and rangelands. To help portray the future development, FRAP overlays vegetation maps with projected development maps to create decade-by-decade snapshots of the intersection of future vegetation and housing density.

Development becomes ecologically relevant when it reaches a density high enough to compromise ecological function. For purposes of analysis, the development threshold of one housing unit per 20 acres (32 per square mile) is assumed to be relevant to at least some potential for ecological impact. Development includes low-density rural residential development called “parcelization” where development has one housing unit per 20 acres, but has not reached 1 housing unit per acre. Development also includes high density “urbanization,” where housing densities are greater than one housing unit per acre.



Rural development in El Dorado County. Photo courtesy of Serrano Associates, Inc.

FRAP produces an assessment of development on land cover that uses the FRAP: Multi-Source Land Cover data as the baseline for charting projected potential development trends by decade to 2040. See the Assessment document [Assessment Information Systems](#).

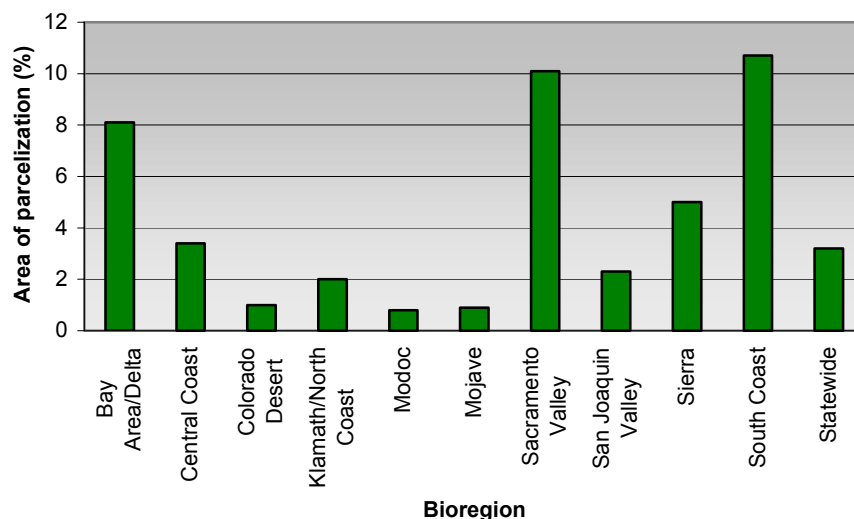
Rural residential lands (parcelization) in forests and rangelands

Parcelization is defined as low-density rural development—densities of at least one housing unit per 20 acres but not exceeding one housing unit per acre. While the conversion of land to urban uses (greater than one unit per acre or commercial/industrial use) has relatively obvious and straightforward impacts due to the nearly complete loss of natural vegetation, the more extensive parcelization at the fringes of urban areas retains at least some ecologically important characteristics.

Parcelization is also an indicator of probable future urbanization. FRAP has conducted studies of historical housing growth in California that show parcelized areas are highly likely to trend towards urban levels. By understanding where and how such parcelization occurs, land use planners, stakeholders, and other decision makers can prioritize measures to protect biological diversity and other values.

The highest current levels of parcelization occur in the South Coast and Sacramento Valley bioregions, affecting more than 10 percent of the forest and rangeland extents (Figure 3). The Bay Area/Delta bioregion is also highly parcelized (approximately eight percent). Least parcelized are the Modoc, Mojave, Colorado Desert and Klamath/North Coast bioregions (all with less than two percent of area parcelized). The San Joaquin Valley bioregion has significant parcelization within agricultural lands, but not within the remaining forests and rangelands.

Figure 3. Percentage area of current forests and rangelands with rural residential development (parcelization)* by bioregion and statewide, 2000



* housing density of one or more housing unit per 20 acres and less than one unit per acre.

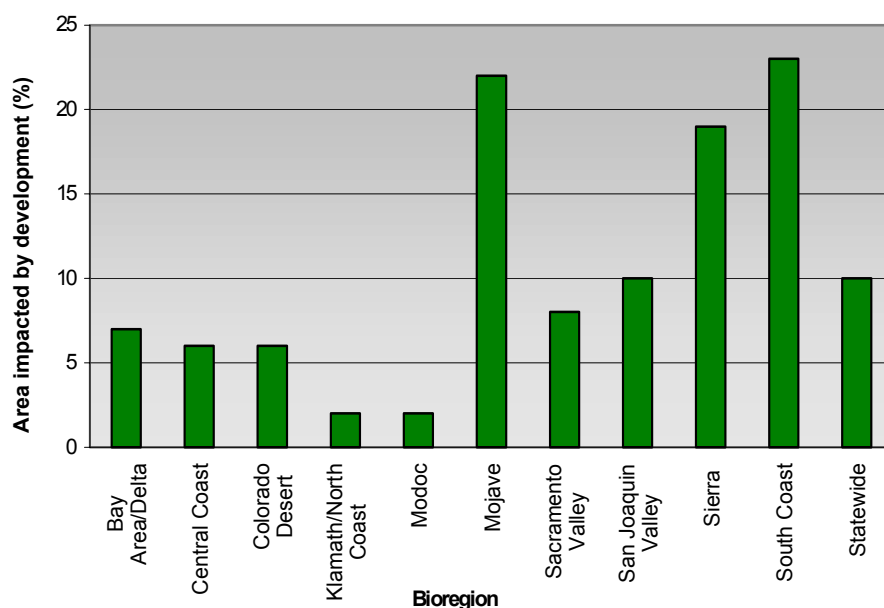
Source: FRAP, 2002a; FRAP 2003c

Projected loss and alteration of land cover due to housing development

To project impacts of future housing development on loss of forest and range habitats, FRAP estimated the projected locations of new housing development and intersected them with FRAP's land cover data (Figure 6). This overlay produces information on the privately owned land covers and locations that will likely be impacted by housing development between 2000 and 2040.

Bioregional trends in projected development—high density urbanization with housing densities of at least one unit per acre and low density parcelization, with at least one housing unit per 20 acres—show double digit projected percentage losses in private forests and rangelands in the Mojave, South Coast, Sierra, and San Joaquin Valley bioregions (Figure 4). It is within these regions where the greatest probability of significant habitat loss and fragmentation exists if policy tools, such as easements and acquisitions, are not used to maintain habitat connectivity.

Figure 4. Percentage area of current private forests and rangelands potentially impacted by projected development* by 2040, by bioregion and statewide



*housing density of one or more units per 20 acres

Source: FRAP, 2003b

Over the next 40 years, development is expected to impact approximately 2.6 million acres of private forests and rangelands (Table 1). Rangeland cover types (Hardwood Forest and Woodland, Shrub, Grassland, Desert) will experience the most development, reaching 2.2 million acres by 2040. This exceeds the projected development of agricultural land (1.1 million acres) (Figure 5).

Table 1. Projected area and percentage of current private, undeveloped land cover classes potentially impacted by new development* by decade to 2040 (thousand acres)

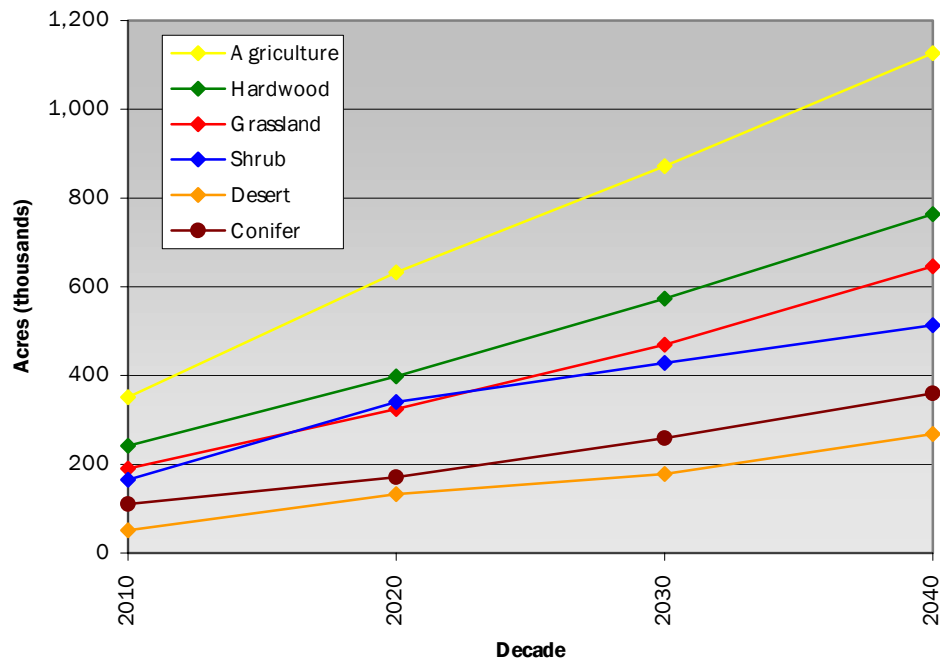
Land cover type	2000 undeveloped land base	Area developed at density of at least one housing unit per 20 acres				Total 2000-2040	Percentage loss 2000 to 2040
		2000-2010	2010-2020	2020-2030	2030-2040		
Conifer Forest	5,560	105	58	85	95	343	6
Conifer Woodland	425	6	2	4	5	17	4
Hardwood Woodland	3,630	147	103	101	113	463	13
Hardwood Forest	2,394	95	54	74	78	300	13
Grassland	8,144	190	134	145	177	646	8
Shrub	4,156	165	175	88	85	514	12
Desert Shrub and Woodland	3,078	51	82	45	91	269	9
Wetland**	122	1	0	1	0	3	2
Total forest and rangeland	27,510	760	608	543	644	2,554	9
Agriculture	8,563	351	281	240	254	1,126	13
Total	36,073	1,111	889	783	898	3,681	10

*housing density of one or more units per 20 acres

**Only the Wet Meadow CWHR habitat type is considered forests and rangelands

Source: FRAP, 2003b

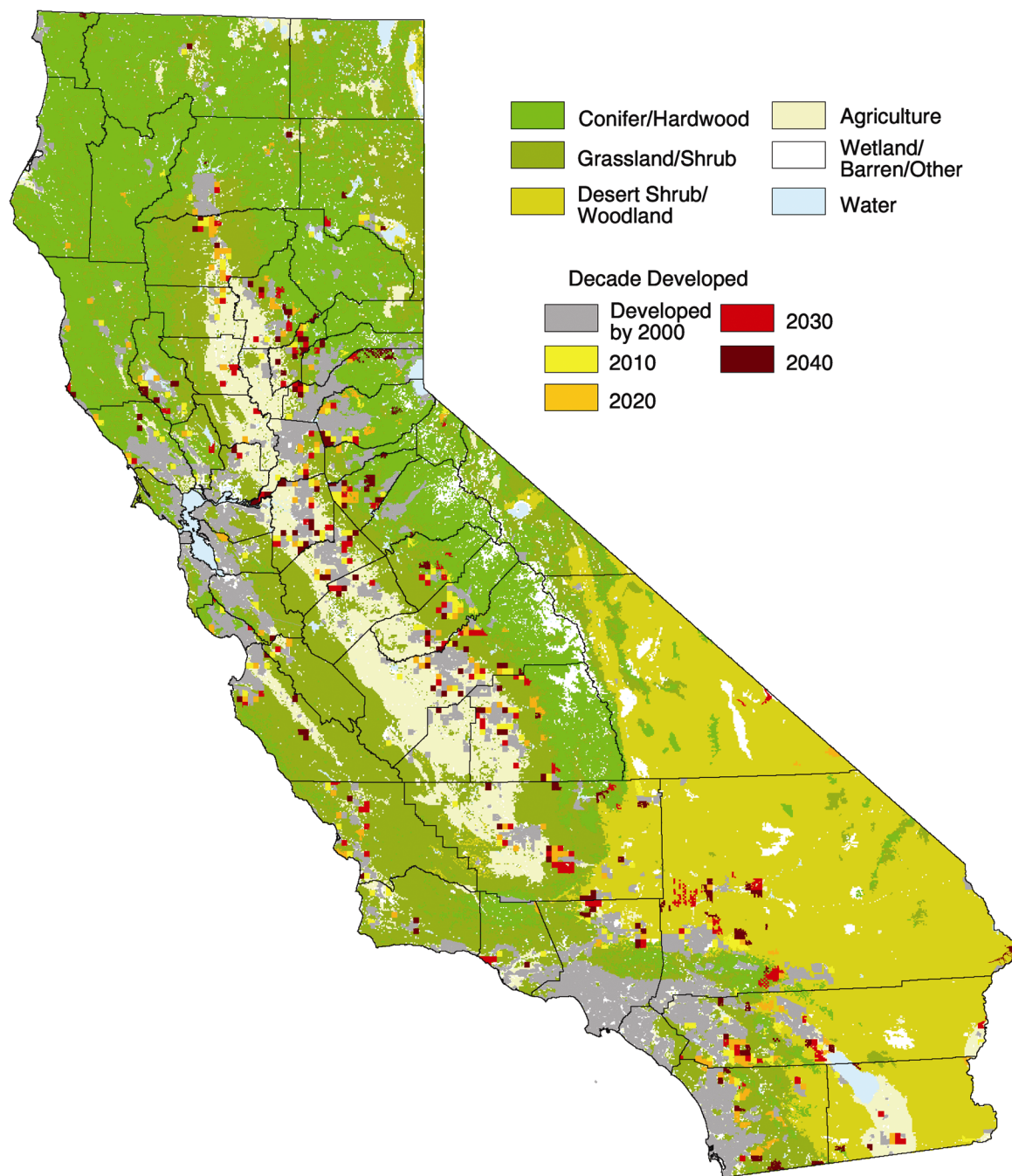
Figure 5. Projected area of new development* on private land cover types by decade to 2040



*housing density of one or more units per 20 acres

Source: FRAP, 2003b

Figure 6. Projected development* by decade to 2040 and current land cover



* housing density of one or more units per 20 acres

Source: FRAP, 2003b